can has not been the slowest to move. It may be that our people are too busy making the things required for munitions to be able to give the matter adequate attention, but we could wish to see the same signs of intelligent and organised effort on the part of the general body of chemical manufacturers in this country as we are now witnessing on the other side of the Atlantic. There can be no doubt whatever that with the fierce industrial struggle that will certainly follow the cessation of hostilities, a very serious time, fraught with the greatest peril, is in store for us, and in particular for our chemical industries. With powerful rivals on either side of us, nothing but the application of the same means, the same enlightened skill and intelligence that in the past have brought pre-eminence to Germany, and are now rapidly bringing it to America, can possibly save these industries from ultimate extinction.

It is not our purpose to follow Mr. Waggaman in his account of the methods of manufacture of sulphuric acid except in so far as they throw light on their comparative advantages in special circumstances, or deal with questions peculiar to America. As regards the contact process, his remarks as to its excellences and its commercial limitations are judicious and to the point. It is admittedly a process which demands skilled and intelligent supervision, and in which there is no room for the rule of thumb type of procedure which characterises much of the foreman management in this country. Doubtless the last word has not yet been said on "catalysers" and "poisons," and there is still room for the ingenuity of chemical engineers in the improvement of plant. But, as matters stand at present, for certain grades of oil of vitriol, and especially for those used generally in the manufacture of fertilisers—one of the most important of the outlets of production—chamber acid will probably hold its own for many years to come, especially in view of the important improvements and simplifications in plant and procedure which have been introduced within recent years.

Of the various methods which have been proposed from time to time for accelerating the chamber reactions, those which seem to have found most favour in the States are Pratt's, Meyer's, and Falding's.

In Pratt's process (U.S. patents Nos. 546, 596, 652, 687), which appears to be much used in the southern States, the gases are drawn through the first chamber by a fan, then through a tower packed with quartz, down which flows dilute sulphuric acid, when they are again introduced, by the same fan, into the first chamber. In a number of plants in which this circulatory system is employed less than nine cubic feet of chamber space are required per pound of sulphur burned in twenty-four hours.

In Meyer's arrangement, of which three installations are in use in the States, "tangential" chambers, designed so as simultaneously to mix and cool the reacting gases, are employed. These chambers are cylindrical in form; round the first run lead pipes conveying cold water. The gases are admitted at a tangent near the upper part of the chamber walls, and are discharged from outlets in the centre of the base, thereby acquiring a spiral motion which tends to mix them thoroughly.

In the Falding system the chambers are approximately one and a half times higher than their horizontal dimensions. The gases after passing through the Glover tower are introduced into the chamber near the top, where, being hot, partly from the fact that they have only recently issued from the burners, and partly because their temperature has been raised by the reactions between certain of their constituents, they collect in the upper part of the chamber and form an active layer, which gradually cools and settles down to the bottom of the chamber, where the spent gases are drawn off. It is claimed that this system requires much less chamber space in which to complete the reactions than the ordinary type. Each Falding chamber is a unit in itself, and is connected directly with the Glover tower, instead of in series as in ordinary chamber systems. Whatever doubts may exist as to the proper explanation of the mechanism of the process, it seems to be commercially successful, to judge from the number of plants in which it is in operation.

The new modification of the chamber process to which Mr. Waggaman refers consists of a method of more quickly effecting an admixture of the reacting gases by causing them to traverse a spiral tube of lead, kept at a determinate temperature. The arrangement has only been tried on a laboratory scale, but from the published results it promises well. Whether it will diminish the chamber space to the extent of 0·139 cubic foot for every pound of sulphur burned in twenty-four hours, as is claimed, seems too good to be true. Comparative experiments using glass and lead spirals appeared to indicate that the metal exerted a specific (catalytic) action. The construction of a sulphuric acid plant along the lines indicated by the author, if successful in working, would certainly greatly diminish the amount of ground space needed, and would presumably decrease the initial cost of construction. The practical man is apt to deride laboratory experiments, forgetting that all factory experience has its beginning in small scale trials. Perhaps he may think it significant that "if patent is allowed, it will be donated to the people of the United States."

NOTES.

EARLY in 1914 a committee representative of British geologists and friends of Sir Archibald Geikie was formed with the object of presenting to the Museum of Practical Geology a suitable memorial of his long association with that institution as director-general of the Geological Survey and Museum, and as a record of their appreciation of his brilliant labours in the cause of geology. It was decided that the memorial should take the form of a marble bust. On Tuesday, March 14, a number of Sir Archibald Geikie's friends assembled in the museum to witness the presentation. Dr. A. Strahan, director of the Geological Survey and Museum, briefly recapitulated the history of the movement. The Right Hon. Sir William Mather, who was to have unveiled the bust, was unfortunately prevented from attending by a chill, but his place was kindly taken, at the last moment, by Sir William Garforth, who had played a very active part on the committee. After unveiling the bust, Sir William referred in cordial terms to Sir Archibald's contributions to science and literature, and then, on behalf of the subscribers, presented the bust to the museum. The Right Hon. J. Herbert Lewis accepted the gift on behalf of the Board of Education; he remarked that it was a source of gratification to the Board that the artist commissioned to execute the bust happened to be another of its distinguished servants, Prof. E. Lanteri, who had done so much to uphold the standards of the Royal College of Art. The Right Hon. Lord Rayleigh then, on behalf of the subscribers, presented to Sir A. Geikie a marble replica of the bust. In warmly acknowledging his appreciation of the gift, Sir Archibald spoke of the powerful effect the Museum of Practical Geology had had upon him in his early student days, and of the great educational value of its collections. The bust is a remarkably good likeness and a beautiful example of Lanteri's work. Among those present at the ceremony were Sir T. Lauder Brunton, Sir Lazarus Fletcher, Sir Thomas H. Holland, Sir F. G. Kenyon, the Right Hon. Lord Lyell, Major F. G. Ogilvie, Prof. W. W. Watts, Dr. A. Smith Woodward, and Messrs. Bedford McNeill and C. McDermid, representing the Institution of Mining and Metallurgy.

Members of the British Association who attended the Dundee meeting in 1912 will remember the striking announcement made on the first night, that Sir James Caird (then Dr. Caird), one of the leading business men of the city, had given the sum of 10,000*l.* towards the funds of the association. We regret now to announce that this eminent citizen of Dundee, and great public benefactor, died on March 9, at seventy-nine years of age. During his lifetime his donations for public purposes amounted to a quarter of a million pounds, among them being, in addition to the gift to the British Association, 5000*l.* to the Royal Society, 24,000*l.* for Shackleton's Antarctic Expedition, 1000*l.* to the Zoological Society of London, and gifts of valuable collections to the Dundee Museum. In 1903 the University of St. Andrews, "in consideration of his great and practical interest in the philanthropic and educational work of the city," conferred on him the degree of Doctor of Laws, and he received the distinction of a baronetcy in 1913.

The death of Lady Baker, widow of Sir Samuel Baker, closes one of the most romantic careers in the history of the Upper Nile and Uganda. She was Hungarian by birth, being a daughter of Finian von Sass. She nursed Samuel Baker through a serious illness, and her devotion then led to a marriage of exceptional harmony and usefulness. It was doubtless largely owing to her influence that Baker developed from a sportsman into a geographer and ultimately into a statesman. He went to the Upper Nile to shoot big game; he gradually devoted more and more of his attention to geographical exploration, and finally, as he and his wife realised the deplorable condition of the natives, Baker entered on the crusade for the suppression of the slave trade, which led to the Egyptian conquest of the Sudan and the African work of Gordon. In the widening of Baker's sympathies and his adoption of a philanthropic, political mission, he was obviously inspired by his wife. She accompanied him on his expedition in 1860–62 into Abyssinia, and on the important expedition of 1862–65 which discovered the Albert Nyanza, and she returned with him to the Upper Nile in 1870, and on the expedition which established Egyptian supremacy there, and began the long campaign against the Sudan slave trade, which was pursued with varying fortune until the collapse of Mahdism and the Anglo-British reconquest. Lady Baker proved throughout of heroic courage, gifted with remarkable insight into the native mind, and exceptionally fertile in resource. On more than one occasion her quick realisation of danger and prompt action saved the expedition from disaster. In 1874 Sir Samuel Baker purchased an estate near Newton Abbot, South Devon, where he died in 1893, and where Lady Baker lived until her death on Saturday last, March 11.

Sir John Wolfe Barry has been elected an honorary member of the Institution of Civil Engineers.

Dr. Th. Hesselberg informs us that since the beginning of this year he has taken up his functions as director of l'Institut meteorologique de Norvège, Kristiania.

The Institute of Industry, Ltd., has arranged a conference of representative trade interests to be held at the Savoy Hotel on Thursday, March 30, to discuss "The Creation of a National Organisation adequately representing British Industrial Interests."

At the meeting of the Royal Society of Edinburgh, held on March 6, the following candidates were elected Fellows of the Society:—Dr. R. J. T. Bell, Dr. F. E. Bradley, Mr. H. Briggs, Mr. C. T. Clough, Dr. E. J. Crombie, Mr. E. H. Cunningham Craig, Dr. A. W. Gibb, the Hon. Lord Guthrie, Prof. P. T. Herring, Sir Duncan A. Johnston, Mr. H. Levy, Dr. J. E. Mackenzie, Dr. W. F. P. M'Lintock, Prof. R. Muir, Dr. J. Ritchie, Mr. D. Ronald, the Hon. Lord E. T. Salvesen, Mr. D. R. Steuart, Mr. J. Martin White.

Many in England will receive with great regret the news which has reached us that Prof. Oswald Kulpe died in Munich on December 30, 1915, at the age of fifty-three. He was well known to students in this country for his original work in psychology and philosophy. He was associated with Prof. Wundt in the foundation of the experimental laboratories at Wurzburg, Bonn, and Munich. One of his recent works, "Die Philosophie der Gegenwart," has been translated into English and published under the title, "Present Philosophy in Germany." He visited this country in May, 1914, on the invitation of the University of London, and delivered a course of lectures on æsthetics at Bedford College.

THE retirement of Dr. Theodore Thomson, C.M.G., from the post of assistant medical officer of the Local Government Board about three years ago, and his recent death at the age of fifty-nine, deprived that Board of an extremely able public servant. Prior to his appointment as a medical inspector of the Board, Dr. Thomson had held the post in succession of medical officer of health of Sheffield and Aberdeen, and in these positions had shown the high quality of work which characterised his later work in a Government Department. His name will always be associated with important reports on two of the largest epidemics of enteric fever, due to water-borne infection, which have occurred in this country, at Maidstone and Worthing respectively. These reports are a model of precise statements of results, as well as of methods of investigation. In the important international work of the Local Government Board, Dr. Thomson for many years took a chief part, and he was the British delegate in 1903 to the International Sanitary Conference of Paris, and signed the International Sanitary Convention as the Plenipotentiary of the British Government. For this work and his special mission of inquiry into the sanitary defence of the Persian Gulf he was nominated a C.M.G. in 1905.

IN a lecture recently delivered before the Hyderabad (Deccan) Archæological Society, Sir John Marshall, Director-General of Archæology in India, directed attention to the importance of the Deccan as a field for inquiry. The points on which investigations in this region may be expected to throw light are: the date of the interments usually supposed to be prehistoric, but probably of a later age; whether the copper culture of northern India extended south of the Vindhyan range, and whence the use of iron was introduced. Recently a rock inscription of Asoka has been discovered at Maski, unique inasmuch as it refers to the Emperor under his own name, these edicts of Asoka being the earliest records we possess in India, except one bearing an Aramaic inscription recently found at Taxila. He went on to refer to the number of cave temples and monasteries, the paintings in the Ajanta and Ellora caves, and the splendid series of Saracenic buildings scattered over the region. The new society has a great work before it, and under the skilful supervision of Sir John Marshall important results bearing on the ethnography and history of southern India may be confidently expected.

IN an article in the *Daily Telegraph* of February 29 Sir Robert Hadfield points out that most of the discoveries which have proved of industrial importance have not emanated from Germany. It must be remembered, however, that the country in which the discovery is made does not of necessity reap the benefit which accrues from its commercial exploitation. When, as in Sir Robert Hadfield's own case, the discoverer can foresee the industrial possibilities, and is able to put his ideas into practice, success is bound to follow. He quotes Mr. C. R. Darling as showing that none of the prominent advances in connection with pyrometry have originated in Germany; but here again the important industry which has arisen in this country in the manufacture of pyrometers is due to the skilled scientific men who have seen how to apply new principles to the production of useful instruments. All the evidence shows that our future commercial success depends upon a closer alliance between science and industry. No scheme to achieve this end can be complete which does not foster the prosecution of laboratory research, and thus provide the seeds from which industries grow. Encouragement and financial aid should be given to all who devote themselves to research; and to this end funds should be forthcoming, either from private sources or the Government, or from both. In this way the laboratory can be connected with the workshop, to the great advantage of both.

THE *Pioneer Mail* of February 5 contains an interesting account of the presidential address delivered by Dr. H. H. Hayden to the Mining and Geological Institute of India, which dealt particularly with problems raised by the war. As director of the Geological Survey of India, Dr. Hayden spoke with the authority of an expert, and his description of the German metal ring and its vast ramifications was peculiarly instructive. He explained that for years past Germany had been gradually acquiring control, not only of metals, but also of the raw materials for their production. Her activities embraced Europe, America, Australia, and India. In Australia, for example, the Zinc Corporation had contracted to sell to her all their concentrates until the year 1919; Germany took the entire wolfram output of Burma, and the monazite sands of Travancore were being worked by German firms, the production of thorium nitrate being so regulated that the gas-mantle industry was completely controlled. Dr. Hayden then turned to India's opportunities of developing her own resources. The wolfram output of Burma is being expanded; the tungsten industry has been taken out of German hands, and a new British industry has been established. Dr. Hayden suggests that it would pay to make ferro-tungsten on the spot if the electrical method could be economically introduced into Tavoz. Dr. Fermor has shown that the manufacture of ferro-manganese may be regarded as a sound commercial proposition. If, then, India can arrange for the partially finished product to be exported instead of the ores, the tungsten and manganese industries should be assured of that permanence which is so desirable. Dr. Hayden also touched on the question of the manufacture of coal-tar dyes and the glass industry, especially in the matter of the supply of glass bangles, which latter he regards very hopefully.

WE are pleased to note from an inaugural address published in our American contemporary, *Science*, that there has been formed recently in the city of Rochester, N.Y., an "Association for the Advancement of Applied Optics." The event is one which marks the growing estimation by scientific men, and we hope also by the community at large, on the other side of the Atlantic of the importance of the subject of applied optics. During the past few months we have several times directed attention in these columns to the governmental, scientific, and popular neglect of this very important subject, and to some of the consequences of its neglect in our own country in connection with the war. It has been shown how we, the successors of Newton, Young, Herschel, and other leaders in the early development of the science of optics and its applications, have allowed our German rivals to occupy the ground during the last twenty or thirty years. Not that we have been idle during that time, but that our efforts have not been commensurate with the ever-growing importance of the subject. For instance, we have anticipated our American cousins in this very matter, for we have had since 1902 a scientific society, "The Optical Society," the work of which completely covers the ground planned out for the new association in America. Its new president, Mr. W. J. Cheshire, a well-known worker in optics, has just succeeded the retiring president, Dr. W. Ettles, a well-known ophthalmologist, and its list of past presidents includes the familiar names of Dr. Silvanus P. Thompson and Dr. R. T. Glazebrook. What is wanted here is a keener appreciation by the scientific and general public of the importance of the work to be done. We venture to hope that the action of our American colleagues will stimulate interest here, and we wish the new association a successful career, especially as from the inaugural address in our contemporary we find that its founders are fully alive to the far-reaching ramifications of applied optics.

With the death in France of Mr. Frank Southgate a unique personality in the world of bird-men has passed away. As a landscape painter of the coast of Norfolk and the broads (the delicate atmospheric effects of which he could catch in a magic way), he is of course most widely known. Here we are only concerned with his life studies of birds, although his ability to paint the scenes in which these birds live adds greatly to the beauty of his pictures. A sportsman and a naturalist, no one knew better than he did the appearance, the movements, and the attitudes of those marsh-, shore-, and sea-birds which he delighted to study. But no one else has ever been able to reproduce them in pictures so successfully. Perfectly able, as he was, to draw and paint a detailed portrait of a bird, he aimed rather at showing us exactly what the birds looked like at a little distance in their natural haunts. Who among those who are familiar with the east-country books which he illustrated has not delighted in "The Fringe of the Shore," the "Stricken Mallard," and "A Corner in Broadland," for instance, to be found in "Notes of an East-coast Naturalist." But it was perhaps in depicting birds in flight that his gift of painting live birds was most remarkable. "Smack putting up Common and Velvet Scoters," in the last-named book, is a good instance of his powers. No subject of this kind was too daring for him to attempt, or too difficult to surmount. But we think that when he painted the heron dropping down to alight "In the old fen" ("Wild Life in East Anglia"), he probably reached the climax in this kind of illustration. As we look at the picture once more we marvel again at any artist daring to make the attempt—and at his success.

The Paris Academy of Sciences awards each year a certain number of prizes to authors of important contributions to science. At the recent annual meeting of the academy, the president, M. Gaston Darboux, gave an account of the careers of men, for the most part young, to whom these prizes had been awarded, but who have fallen in the service of their country. M. Marty (Francœur prize), killed September 10, 1914, at the battle of the Meuse, was distinguished by his contributions to mathematics. M. R. Marcelin (Hughes prize), killed near Verdun, in September, 1914. His work on kinetic physical chemistry was remarkable, both in theoretical treatment and on the experimental side. M. Marcel Moulin (Gaston Plante prize), killed at the battle of the Marne, September 6, 1914, founded the Institute of Chronometry at Besançon. M. Viguier (Cahours prize), killed at Beausejour, March 5, 1915, made his mark in the field of organic chemistry. M. Albert de Romeu (Delesse prize), killed January 12, 1915, at Bucy-le-Long, near the Aisne, was the author of noteworthy petrographic work. M. Rene Tronquoy (Joseph Labbe prize), wounded and missing, February 20, 1915, was proposed for the Cross of the Legion d'honneur, and was well known for his mineralogical work. M. Blondel (Saintour prize), wounded and missing, September 8, 1914, at Fere-Champenoise, was distinguished for his work on the theory of tides. M. Georges Lery (Gustave Roux prize), killed at the battle of the Marne, September 10, 1914, was a geometer of great promise. Lieut.-Col. Arnaud (Henri Becquerel prize), aged sixty years, died of illness contracted on active service. M. Jean Merlin (Becquerel prize), on the staff of Lyons Observatory, killed at Arrozel, August 29, 1914. He was known by his researches dealing with the theory of numbers. M. Rabioulle (Becquerel prize), on the staff of the Algiers Observatory, killed in the battle of the Aisne, September 21, 1914. M. Jean Chatinay (Fanny Emden prize), killed at Vermelles, October 15, 1914. Commandant Henri Batailler (Wilde prize), killed June 9, 1915, well known for his researches in ballistics.

It is announced in the *Morning Post* that Mr. Knud Rasmussen, the Danish Arctic explorer, is planning a new expedition to northern Greenland. Mr. Rasmussen's previous work in Greenland is well known. In 1902 he took part in the Danish Literary Expedition with Mylius Ericksen, and in 1908–9 he explored from Cape York to Ellesmere Land. His work has been mainly ethnographical, a task for which Mr. Rasmussen is well suited, as he spent all his boyhood in Greenland, and speaks the Eskimo tongue with fluency. In his "People of the Polar North" he made an exhaustive study of the polar Eskimo from Cape York to Cape Alexander, and probably in this new expedition he means to continue his ethnographical studies. It is proposed that the expedition should start this spring to explore the unknown region between Peary Land and Greenland, or, if ice prevents this, the expedition will first work around Melville Bay. In 1892 Peary, reaching the east coast across the inland ice of Greenland, discovered Independence

Strait, as he thought, cutting off the northern part from the rest of Greenland. That northern part, previously, in 1882, visited by Lockwood, of Greely's expedition, was termed Peary Land, but the late Mylius Ericksen, on that expedition when he lost his life, discovered that the Independence Strait of Peary is really a bay, and that Peary Land is joined to Greenland. The exploration of that region in relation to former migration of Eskimo to the east of Greenland promises important results.

A SUMMARY of the weather for the winter season is issued by the Meteorological Office with its *Weekly Weather Report,* based on the results for the thirteen weeks from November 28, 1915, to February 26, 1916. The winter was wet in all parts of the United Kingdom, the greatest excess of rain occurring in the south-east of England, where the fall was 187 per cent. of the average. In the east of England the rainfall was 169 per cent. of the average, and in the Channel Isles it was 160 per cent. The smallest difference from the normal was 118 per cent. of the average in the west of Scotland, and 119 per cent. in the south of Ireland. The rainfall for the winter was greater in the north and east of Scotland than in the winter of 1914–15, elsewhere the rains were less, and in the south-east of England the rainfall was 4·32 in. less. The frequency of rain was everywhere greater than the average, the greatest excess in the number of rain-days being 18 in the south of Ireland and 16 in the south-east and south-west of England. Temperature for the period was in excess of the average over the entire kingdom, the greatest excess occurring in the east and south-east of England and in the midland counties, the difference from the mean ranging from 3° to 4° F. in these districts. The duration of bright sunshine was nowhere very different from the normal, districts with an excess and defect being about equally balanced.

IN the March number of *Man* Mr. Miller Christy describes a strange stone object found in an interment of the Bronze age in the parish of Newport, Essex. It is fashioned from a block of rather coarse, reddish sandstone, erratic boulders of which abound in the neighbourhood. It is roughly cylindrical in shape, with flat ends, but it was not intended to be stood on end. The most remarkable feature is that its sides are traversed longitudinally by five shallow, narrow, round-bottomed, equidistant grooves, which divide in transverse section into five approximately equal rounded lobes. At present the object of this curious specimen is a puzzle. It was not a pounder or muller. One authority suggests that it was the head of a club lashed to a handle; another, that it was used as a roller for "braying" flax. Mr. Reginald Smith was struck by its resemblance to an Egyptian pillar, derived from the bud of the lotus. If it is really a product of the Bronze age, it is difficult to account for its transfer from Egypt to Essex. The specimen is now in the museum at Saffron Walden, and it may be hoped that Mr. Christy's article will lead to a further examination of this remarkable specimen, which may disclose the object for which it was carved.

FROM the report of Mr. T. Southwell in the Journal of Agriculture of Bihar and Orissa for 1915, which has just reached us, it is plain that the newly-formed Fishery Department of Bengal, Bihar, and Orissa has a strenuous future before it, if a reign of plenty is to replace the present shortage of fish. This state of affairs is due to the lack of intelligent control, and is all the more serious since rice and fish are the principal food-stuffs of the population of these areas. But the Government is taking up the task of reformation with its hands tied, for the fishery rights belong to zamindars, who take no interest in the matter, but lease their fisheries for a nominal sum, the lessee releases at a large profit, and this process goes on through yet further stages. Apart from this, in the Bengal area immense numbers of eggs and young fish are washed by the floods into the paddy-fields and destroyed, while a further extensive mortality is caused by the ascent of brackish water. But Mr. Southwell seems to hold out little hope of material improvement until the staff of the newly-established Board is increased. At present there are but three officers to control an area "one and a half times larger than that of the whole of the British Isles."

THE hereditary transmission of degeneracy and deformities by the descendants of alcoholised guinea-pigs has formed the subject of a long series of experiments by Profs. C. Stockard and G. Papinicolaou. They contribute a very welcome analysis of their results so far obtained to the *American Naturalist* for February. Their experiments show that alcoholic fumes, drawn directly into the lungs and absorbed by the blood, are infinitely more harmful to the offspring than is alcohol taken into the system in the form of drink. Alcoholic fumes made the animals drowsy, or quarrelsome, according to their individual temperament, but they produced no other evil effects during the lifetime of the animal, nor could any injury to the tissues be traced after death. This is notoriously otherwise where men who have been "hard drinkers" are concerned. Guinea-pigs kept in an almost continuous state of intoxication during the reproductive period invariably produce defective offspring, of which very few arrive at maturity. In spite of the fact that alcohol is withheld from them, the offspring of such defectives are still more defective. All are weak and neurotic, some are grossly deformed, many are anophthalmic monsters. Physical wrecks of this sort continued to appear for three generations, when sterility seems to have extinguished further examples. Attempts to administer alcohol in the form of drink, by means of a tube, or mixed with the food, had to be abandoned owing to digestive and other troubles which vitiated the experiments. But before the authors can claim to have demonstrated the destructive effects of alcohol fumes on the germ-plasm, experiments with non-alcoholic fumes must be tried.

A SELECTED bibliography of frost in the United States, especially in relation to agriculture, has been published as a pamphlet by the United States Department of Agriculture. It originally appeared in the pages of the *Monthly Weather Review* (vol. xliii., pp. 512–517). The authors, Messrs. W. G. Reed and

C. L. Feldkamp, have selected their entries from all the material on frost and frost prevention under American conditions that have come to their attention, but disclaim any exhaustiveness for their list. A brief indication of the scope follows each entry. The arrangement is chronological and there is an index arranged according to States. The paper should prove useful to agriculturists.

THE *Geographical Review* is the new title under which the Bulletin of the American Geographical Society appears this year. An introductory note outlines the scheme of the remodelled publication. It is hoped to broaden the range of the articles and to give the notes and reviews a more critical and scholarly quality. A special feature is to be made of the bibliographical section, which, in addition to the record of books and maps, will contain an analysis of all the principal geographical publications and those bearing on geography. The classification adopted is a regional one, and is illustrated in a sketch map in the January issue. If the high standard aimed at is maintained the *Geographical Review* should rank among the most useful geographical publications and be of great assistance in the study of the subject. The January number (vol. i., No. 1), in addition to several shorter articles, notes, and bibliography, contains a lengthy paper by Mr. C. A. Cotton on fault coasts, with special reference to New Zealand.

AN investigation of the world's coal resources was undertaken by the twelfth International Geological Congress, held in Canada in the summer of 1912, with the view of estimating the tonnage available in known fields. In October last the American Geographical Society published in its Bulletin (vol. xlvii., No. 10) a summary of the results, which have been embodied *in extenso* in a monograph of three volumes published by Morang and Co., Toronto, 1913. The author of this summary, Mr. Leon Dominian, finds that on the basis of the present annual consumption of 1300 million tons, the world's coal supply is provided for centuries.

BULLETIN 254 of the Scientific Papers of the Bureau of Standards (Washington: Government Printing Office, 1915) contains a study of the qualities of platinum goods, by Messrs. George K. Burgess and P. D. Sale. The object of the investigations was in the first place to devise a simple thermoelectric test of the purity of platinum, for which purpose the temperature-coefficient of resistance and the thermoelectric force were found useful; in the second place, to investigate the loss of weight due to disintegration when platinum vessels containing various proportions of other metallic constituents are heated.

IN a series of articles in the February numbers of the *Electrician,* Mr. W. R. Cooper has given an account of the properties of selenium which will prove of great value to all those who have in view the technical applications of the sensitiveness to light which the material exhibits. Up to the appearance of these articles it has been necessary to collect information on the subject from the pages of scientific journals published in all parts of the world. Mr. Cooper's articles now provide the information in a convenient and readable form. After an account of the various forms of selenium and the modes of preparation, their sensitiveness to light in general and to variations of the wave-length of the light are discussed. Although a satisfactory general theory has not yet been evolved from the experimental facts now available, there is sufficient information about the behaviour of the material to make it likely that its properties will before long find for it some more extensive application than at present, when it is mainly restricted to the automatic lighting of isolated buoys at sea.

WE congratulate the *Athenaeum* on the promptitude with which it has been able to publish its subject-index to the Periodical, Scientific, and Technological Literature for 1915. The publication of this list within six weeks of the close of the year indexed is a remarkable feat. The list is by no means intended to be a complete index to all branches of scientific literature, but has special reference to the war in its technological aspects. Indeed, a complete list of the scientific papers published throughout the world in 1915 would probably contain 40,000 names of authors, whereas in the *Athenaeum* list we have rather fewer than 2000 names quoted. The subject-index is arranged alphabetically. The following examples of the headings for some of the longer sections will give an idea of the character of the subjects selected for indexing:—"Aeronautics," "Agriculture," "Artillery," "Automobiles," "Birds," "Coal," "Electric Apparatus," "Explosives," "Forestry," "Gas and Oil Engines," "Geology," "Mines," "Railways," "Roads," "Submarines," "Telegraphs," "Telephones," "Warships," and "X-Rays." The articles indexed are taken from 215 periodicals, which are mainly British, although thirty American and seven French periodicals are included, as well as about ten other foreign journals.

Engineering for March 10 contains the last of a series of articles on the whirling speeds of loaded shafts; these articles describe an investigation which has been made at the Royal Technical College, Glasgow, by Mr. W. Kerr. Tests on a 250-kw. turbine, and on a 3-h.p. de Laval turbine, showed some disagreement with the usual theory, and led the author to investigate the matter mathematically. It appears that there is both experimental and theoretical evidence of the existence of a critical speed for loaded horizontal shafts which is considerably below that given by the usual theory. This new critical speed is due in the first instance to the direct effect of gravity, which has been hitherto neglected in the theory. The lower critical speed seems to be less important than the higher, when it is merely a question of running through in the process of speeding up. Also, it is of little importance if the loads on the shaft are very light. In those cases in which it is shown clearly, it is probably due to inaccurate balancing. In general, there will be an undesirable instability at all speeds between the two critical values, and it would be best to keep the normal running speed outside this range.

MESSRS. JOHN WHELDON AND CO., 38 Great Queen Street, Kingsway, W.C., have just issued a catalogue of important books and papers on cryptogamic botany they are offering for sale. The works are arranged conveniently under three main divisions—economic, geographical, and general—each of which is subdivided to facilitate search for works on any particular subjects embraced by the catalogue.

OUR ASTRONOMICAL COLUMN.

COMET 1916*a* (NEUJMIN).—Copenhagen Postcards Nos. 13 and 14 give orbits and ephemerides for this comet calculated by M. J. Fischer-Petersen and Mlle. J. M. Vinter-Hansen. The earlier orbit is based on observations made at Yerkes (February 29), Greenwich (March 1), and at Bamberg on March 3. The second, given below, depends on the Yerkes and Bamberg positions, and observations made at Bergedorf on March 5:—

Perihelion Passage (T), 1916, *March*, 9·417 *G.M.T.*

$$\left.\begin{aligned}\omega &= 191^\circ\ 9'\ 87''\\ \Omega &= 325^\circ\ 24'\ 10''\\ i &= 16^\circ\ 1'\ 48''\end{aligned}\right\}1916{\cdot}0$$

$$\log q = 0{\cdot}19036$$

	R.A. h. m. s.	Dec. ° ′		R.A. h. m. s.	Dec. ° ′
March 15	9 5 41	+5 58·2	March 21	9 10 56	+3 11·1
17	7 17	5 1·2	23	12 57	2 18·1
19	9 2	4 5·4	25	15 6	1 26·7

The orbit is apparently periodic in short period. The comet is fainter than 11·0 mag.

COMET 1915*e* (TAYLOR).—A new orbit and ephemeris for this comet has been calculated by M. J. Braae from observations made at Rome, December 5, 1915, at Arcetri and Copenhagen, January 11, 1916, and at Bamberg and Copenhagen on February 20. The new orbit only differs slightly from the earlier elliptical orbit (NATURE, January 20):—

Perihelion Passage (*T*)=1916, January 30·9122 *G.M.T.*

Epoch 1916 Jan. 0·5 G.M.T.	Equinox 1916·0
$M_0 = 355^\circ\ 17'\ 34{\cdot}6''$	$\omega = 354^\circ\ 47'\ 54{\cdot}9''$
$\mu = 557''{\cdot}191$	$\Omega = 113\ \ 53\ \ 57{\cdot}6$
$\text{Log } a = 0{\cdot}536002$	$i = 15\ \ 31\ \ 51{\cdot}0$
$U = 2325{\cdot}95$ days (6·37 years).	$\phi = 33\ \ 7\ \ 33{\cdot}9$

The comet is very weak, having been about 12 mag. on February 20.

From Bergedorf, Prof. Schorr has reported (Circular No. 503, *Astronomische Nachrichten*) that the nucleus of this comet has divided into two portions. The nuclei were of unequal brightness, about magnitudes 11 and 13. Their positions were:—Distance, 14″; position angle, 169° and 17″ and 25°, on February 19 and 29 respectively. On the latter date the following nucleus was the weaker.

According to a note in the current number of the *Observatory*, Prof. E. E. Barnard observed the double nucleus on February 9, the separation being 10″.

VARIABLE STARS IN THE VICINITY OF R CORONÆ AUSTRALIS.—This region is under careful scrutiny, not only at Helwân, but also at the Union Observatory, Johannesburg. In Circular No. 31 both R Coronæ and the nebula are stated to be variable over a wide range. The observations of these objects are to be discussed later. Thirty-three new variable stars have been detected in the region.

A POSSIBLE DEFLECTION OF LIGHT BY A MOVING MEDIUM.—Prof. P. Zeeman has published (*K. Akademie van Wetenschapen*, vol. xviii., pp. 711–5) an investigation of the propagation of light-waves along a velocity gradient in a moving medium specially in relation to solar phenomena. From a consideration of the Lorentz dispersion term in the Fresnel coefficient, it is demonstrated that the simultaneous existence of velocity gradients and anomalous dispersion in gases that are extremely rare (*e.g.* the absorbing vapours giving rise to the finest lines in the solar spectrum), and without density gradients, may give rise to a deflection of light.

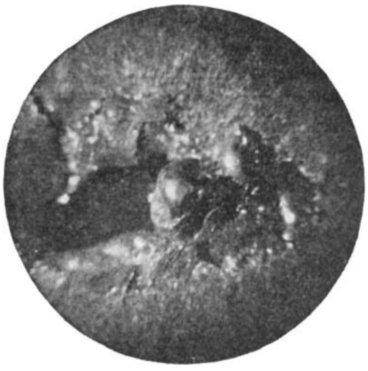
A TUNGSTEN TARGET FOR X-RAY TUBES.[1]

GREAT advances have recently been made in the production of X-rays, chiefly by the employment of very heavy currents. The exposures necessary for producing radiographs of the thorax have been reduced from minutes to fractions of a second.

To make this possible, much attention has been devoted to the target or anti-kathode, which is the critical part of the tube, for here it is that the focus of the kathode stream strikes, and the energy of the bombarding electrons is transformed into X-radiation.

The early English tubes were furnished with substantial targets of platinum, but in the later foreign tubes with which the market was flooded the platinum was often reduced to a sheet of very thin foil laid upon a plate of nickel. For weak currents, and with an imperfectly focused kathode stream, this plan answered moderately well, but if heavy currents were used the heat generated at the focus was often so great that the platinum skin alloyed with the nickel backing, when fusion and destruction of the whole apparatus followed immediately.

This is well illustrated by the accompanying photograph of such a fused target which appeared some time ago in the Journal of the Röntgen Society.


Platinised nickel target damaged by the kathode focus.

Recently attention has been directed to the exceptional properties of pure metallic tungsten, now produced in quantity for the manufacture of metal filament lamps, and its suitability for the purpose was at once recognised, the metal having a fusing point of about 3000° C., as against 1750° C. for platinum. Tungsten is also very tough, and does not readily disintegrate by the kathodic discharge (kathode sputtering); its atomic weight, 180, is not much below that of platinum.

The British Thomson-Houston Company, Ltd., has introduced a special target of this metal that is being largely used by manufacturers of X-ray tubes. The tungsten is in the form of a thick button brazed into a solid block of copper, in some cases weighing as much as half a pound; this forms a lasting and efficient target, even when heavy currents are used

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[1] "Quantitative Measurements of the Conversion of Kathode Rays into Röntgen Rays by Anti-kathodes of different Metals." By J. H. Gardiner. Journal of the Röntgen Society, No. 24, vol. vi.